Kinematics

$v = v_o + at$

$\triangle x = v_o t + \frac{1}{2}at^2$

$v^2 = (v_o)^2 + 2a\triangle x$

Newton's Laws and Forces

1. An object in motion will stay in motion unless acted upon by an net force. An object at rest will stay at rest unless acted upon by a net force.

2. A net force will cause a mass to accelerate. This acceleration is proportionate to the net force and inversely proportionate to the mass.

$$\sum F = ma$$

3. For every force there is a force equal in size and opposite in direction.

Force of Gravity: $F_g = \dfrac{Gm_1m_2}{r^2}$, where G is the Gravitational Constant $(6.67 \times 10^{-11} \dfrac{m^3}{kgs^2})$

Force of a Spring: $U_s = k\triangle x$

Circular Motion and Rotation

$v = r\theta$ where θ is in radians

$a_c = \dfrac{v^2}{r}$, where a_c is Centripetal Acceleration

$\tau = r \times F$, where τ is Torque

For static objects, $\sum \tau = 0$ and $\sum F = 0$

Angular forces: $\sum \tau = I\alpha$

Work, Energy and Power

The Law of the Conservation of Energy: $E_o = E$

Gravitational Potential: $U_g = mg \cdot \triangle y$

Spring Potential: $U_s = \dfrac{1}{2}kx^2$

Kinetic Energy: $K_e = \dfrac{1}{2}mv^2$

Angular Energy: $K_{rot} = \frac{1}{2}I\omega^2$

Power is $\dfrac{Work}{Time}$

Work is measured in Joules, just like Energy. Power is measured in Joules/second.
One Watt is 1 Joule/second, and One Horsepower is 746 Joule/second.

Momentum

$p = mv$ where p is momentum

COP: $p_o = p$ (Momentum is conserved in a closed system)

Impulse is a change in momentum caused by some outside factor, and is represented by the letter J.

$J = \triangle p$.

Wave Motion and Sound

Wave Formula: $v = f\lambda$

For all electromagnetic waves, $v = 3 \times 10^8 m/s$.

For sound waves in air, v = 340m/s.
To calculate using temperature, use the formula $v = 330m/s + 0.6(°C)$

For strings, $v = \sqrt{\frac{tension}{linear\ density}}$

For open tubes, $\ell = \frac{n}{2}\lambda$, where n = harmonic ($1^{st}, 2^{nd}, 3^{rd}$)

For closed tubes, $\ell = \frac{n}{4}\lambda$, where n = harmonic ($1^{st}, 3^{rd}, 5^{th}$)